

**14<sup>th</sup> Human Factors in Aviation Maintenance Symposium**  
**Vancouver, March 28-30, 2000**

***Reducing Human Error  
Through Safety  
Management  
Practices***

**James Reason**  
**University of Manchester**  
**UK**

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- But most maintenance managers have a technical background.
- How can we help them create a safety management system that properly addresses the human and organizational risks?

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- Negative face—as revealed by accidents, incidents, near misses, and the like (negative outcomes).

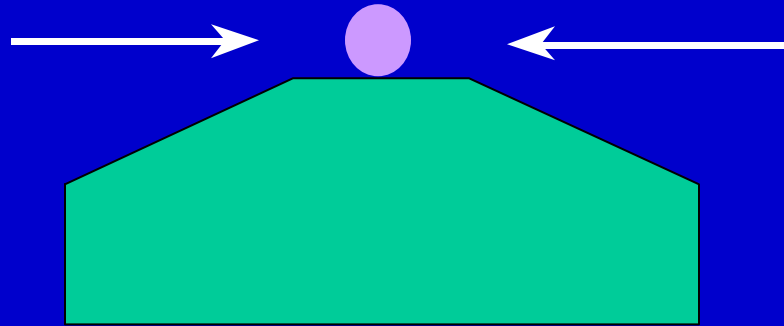
# *The two faces of safety*

- Negative face—as revealed by accidents, incidents, near misses, and the like (negative outcomes).
- Positive face—system's intrinsic resistance to its operational hazards (resilience).

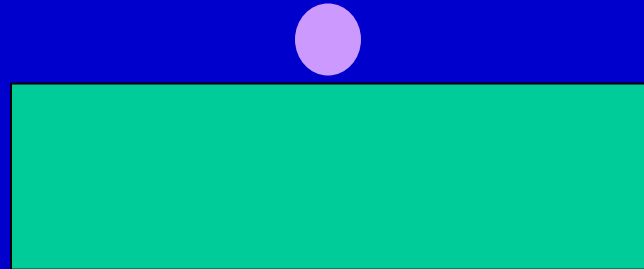


# *Intrinsic safety*

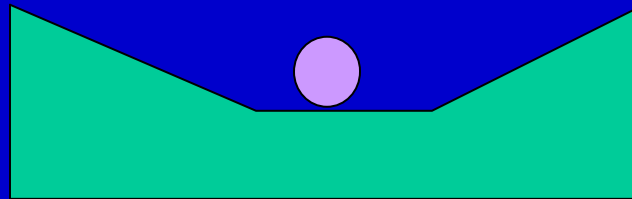
Vulnerable  
system



Average  
system



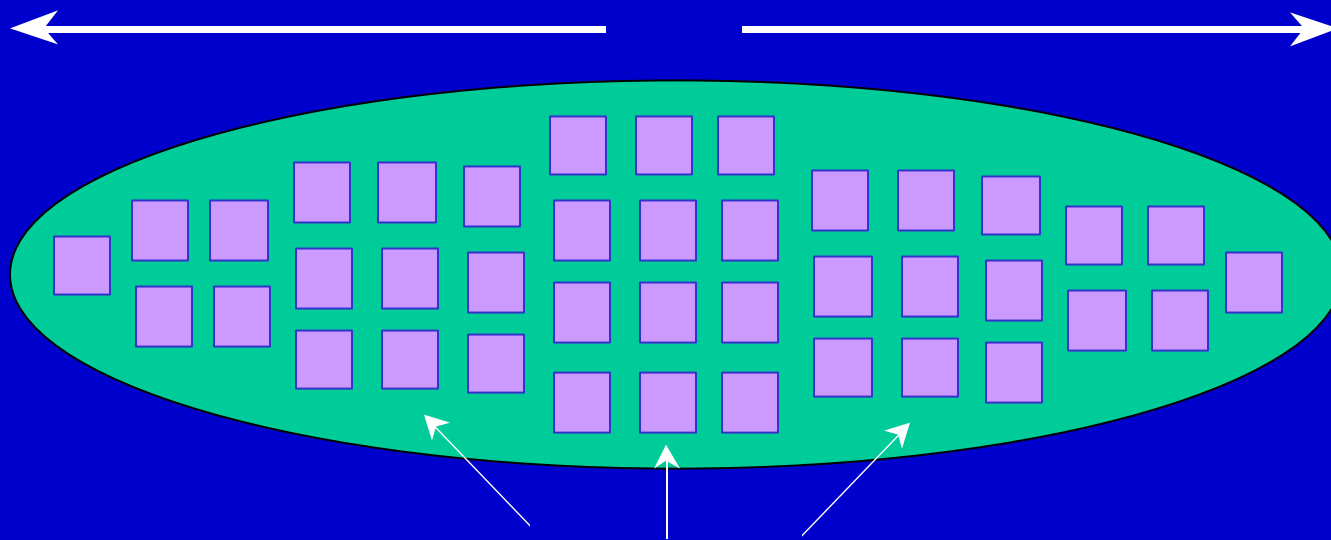
Resistant  
system



# *The safety space*

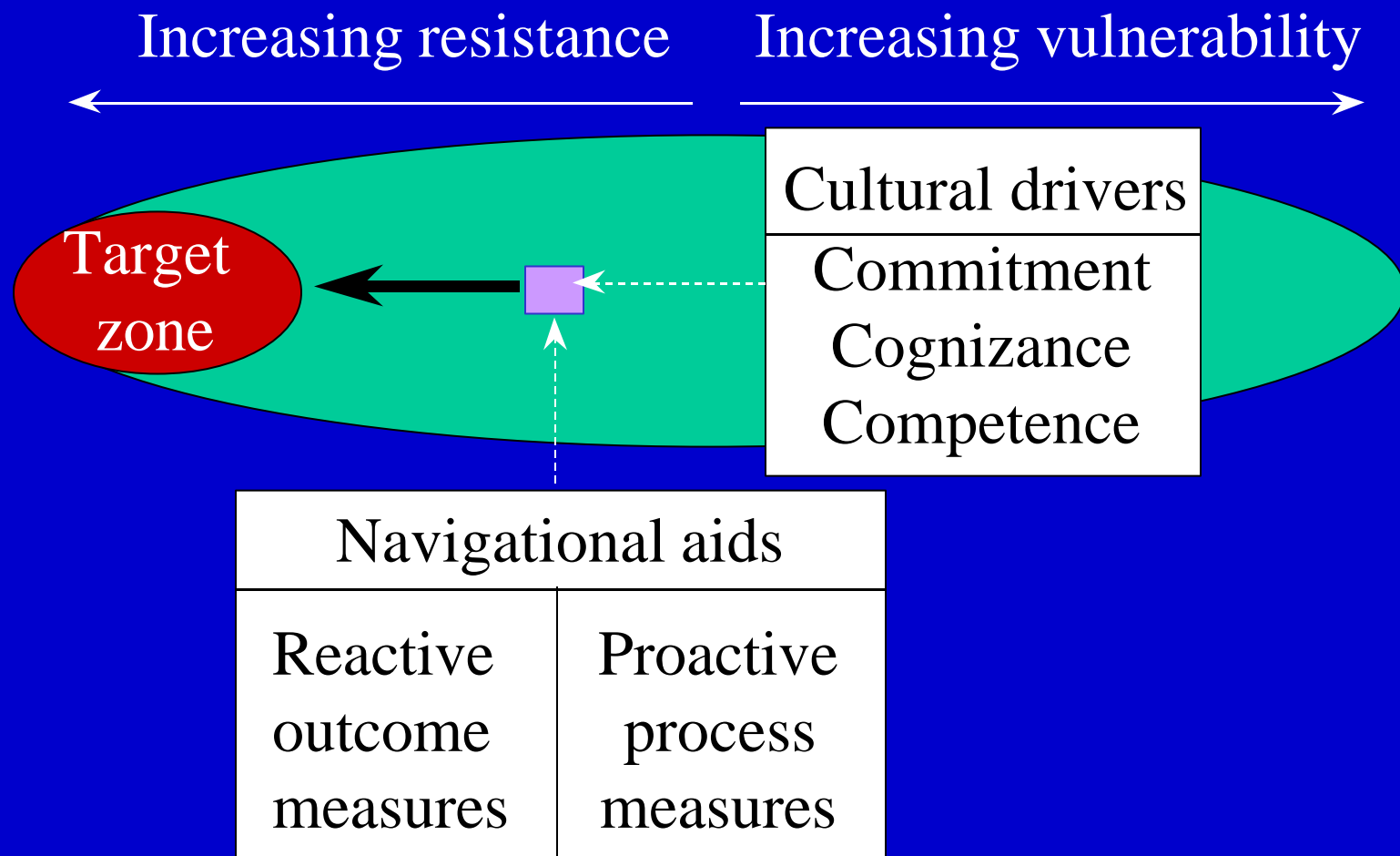
Increasing resistance

Increasing vulnerability



Organizations

# *Navigating the safety space*



# *The three C's*

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- **Commitment:** In the face of ever-increasing commercial pressures, do you have the will to make safety management (SM) tools work effectively?
- **Cognizance:** Do you understand the nature of the 'safety war'—particularly with regard to human and organizational factors?
- **Competence:** Are your SM techniques, understood, appropriate and properly utilised?

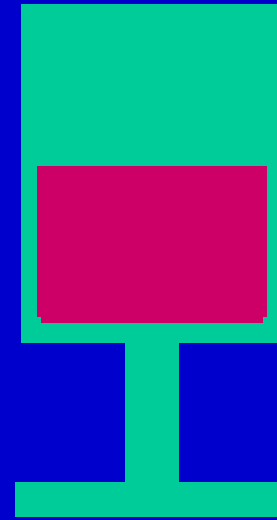
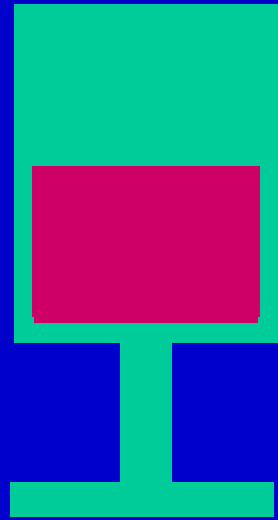
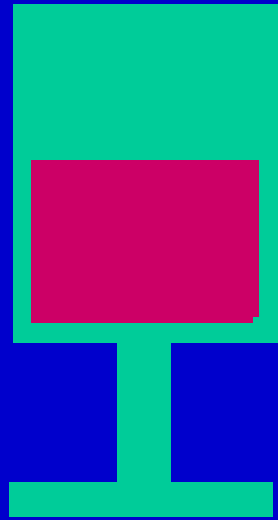
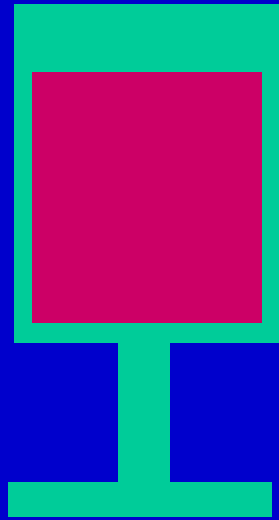
# *The 'navigational aids'*

	<b>REACTIVE OUTCOME MEASURES</b>	<b>PROACTIVE PROCESS MEASURES</b>
<b>Workplace &amp; organizational factors</b>	<b>Analysis of many incidents can reveal recurrent patterns of cause and effect.</b>	<b>Identify those conditions most needing correction, leading to steady gains in resistance or 'fitness'.</b>
<b>Defences barriers &amp; safeguards</b>	<b>Each event shows a partial or complete trajectory through the defences.</b>	<b>Regular checks reveal where holes exist now and where they are likely to appear next.</b>



# *The 4 P's of management*

*(apologies to Earl Wiener)*



**Principles**  
**(Philosophy)**

**Policies**

**Procedures**

**Practices**

# *4Ps x 3Cs = 9 sets of indicators*

	Commitment	Cognizance	Competence
Principles (Philosophy)	1	2	3
Policies	4	5	6
Procedures		7	8
Practices			9

# *1. Principles & commitment*

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- Top management is ever mindful of the possibility of failure. Chronic unease.
- Global reform rather than local repairs.
- Top management actively engages in safety-related issues.

## *2. Principles & cognizance*



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- Understands the particular vulnerability of installation and reassembly.
- Understands the prevalence of certain error types—omissions.

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- Recognises strengths & limitations of various indices of safety (outcome vs. process).
- Recognises that the management component of SM is the hardest to achieve.
- Recognises existence of error traps and has taken steps to deal with them.



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- Protection will override production if circumstances require it.
- Messengers will be rewarded not shot.

## *5. Policies & cognizance*

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  - Reporting culture
  - Just culture
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  - Reporting culture
  - Just culture
  - Learning culture
- Management & first-line supervisors (at least) to receive Human Factors training.



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- Reporting system policies:
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  - Confidentiality and/or de-identification
  - Separation of data collection from disciplinary procedures
- Disciplinary system policies:
  - Agreed distinction between acceptable & unacceptable behaviour
  - Peers involved in disciplinary proceedings

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- Procedures should be written in consultation with those actually doing the job.

## 8. *Procedures & competence*



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- Procedures to be:
  - Intelligible
  - Workable
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- Procedures to be:
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- Awareness that people hardly ever read and do at the same time.
- Knowledge required to do a job should be shared between procedures, reminders & forcing functions.

## 9. *Practices & competence*

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- Throughout, efforts are made to generalise rather than localise failures.
- Visible top-level involvement: walking the talk & talking the walk.



# *Interim conclusions*

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- These indicators have tried to capture some of the characteristics of high reliability organizations, as we presently know them.

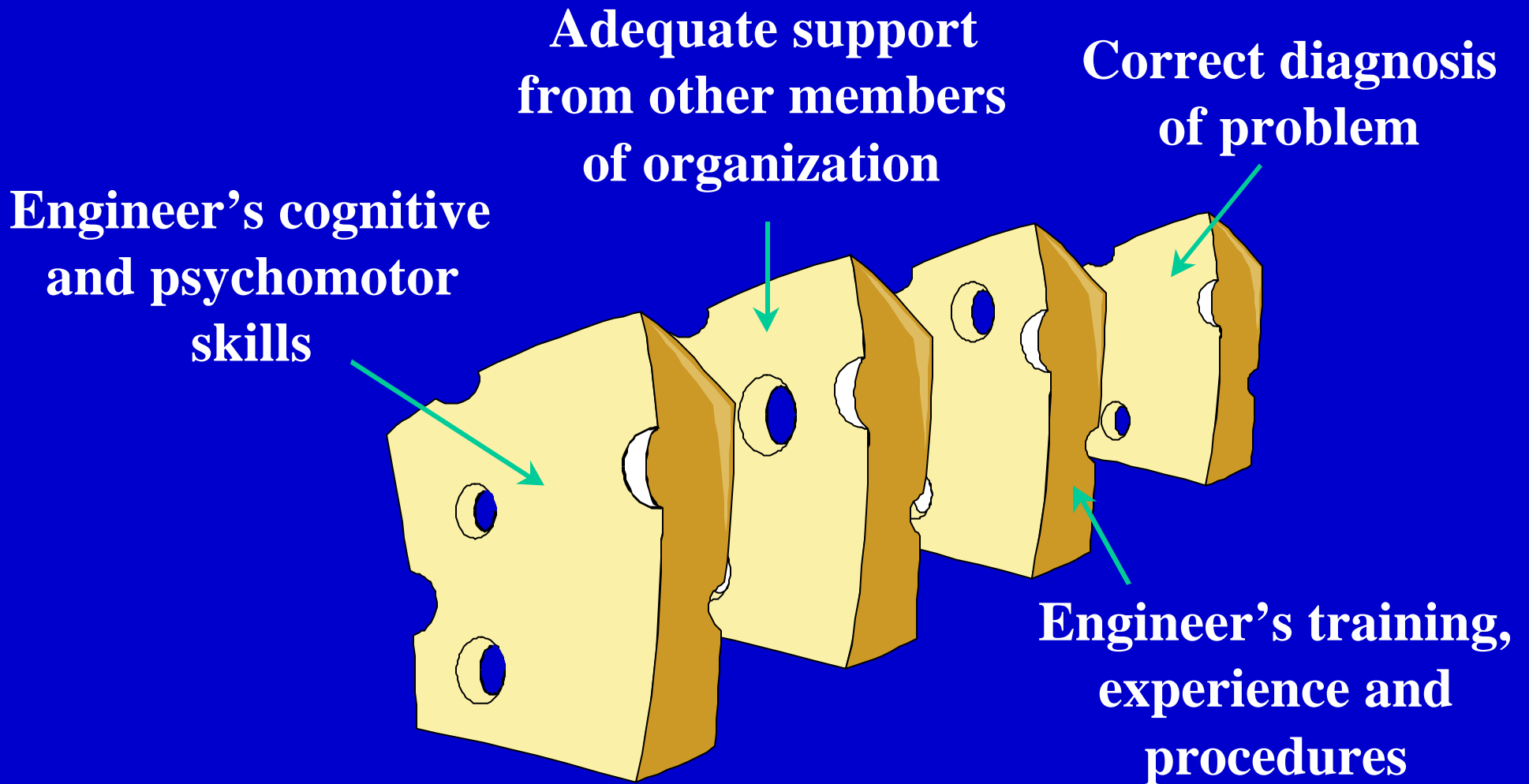
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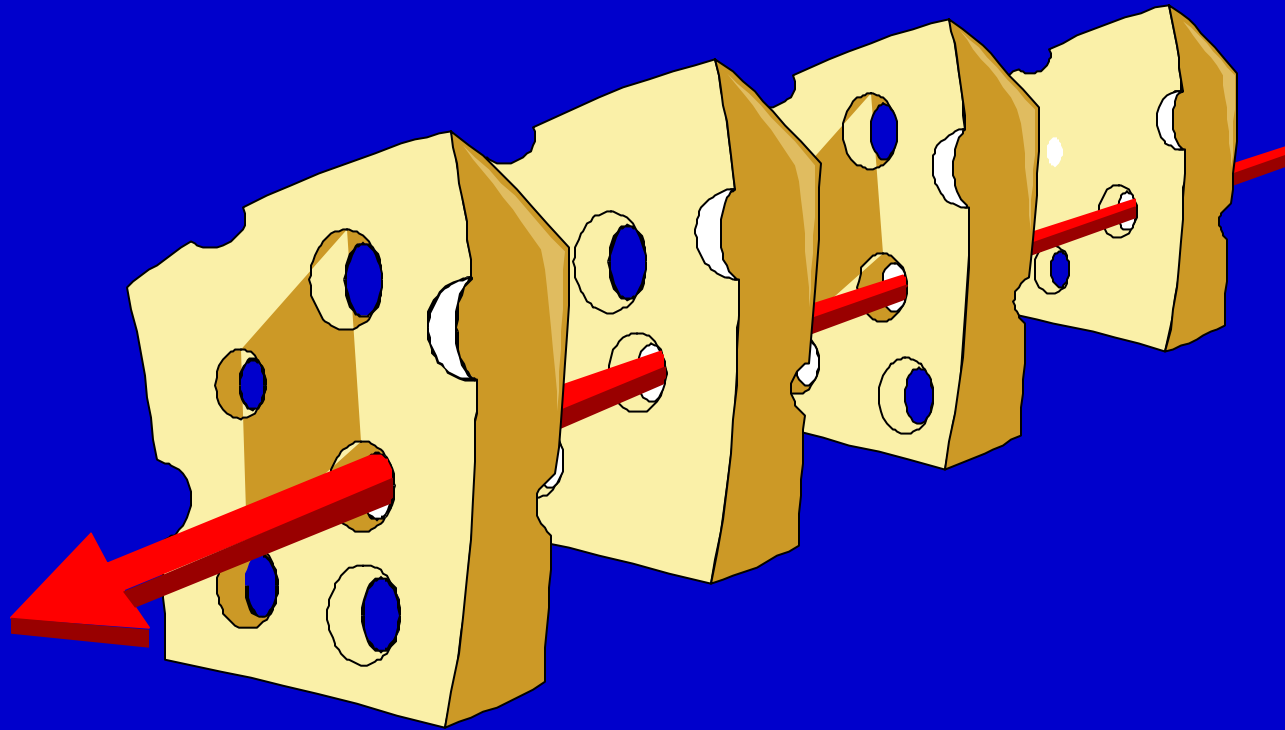
# *Interim conclusions*

- These indicators have tried to capture some of the characteristics of high reliability organizations, as we presently know them.
- No one best way: different programmes suit different organizations.
- Unlikely that any organization possesses all of these features.

# *Local maintenance defences*

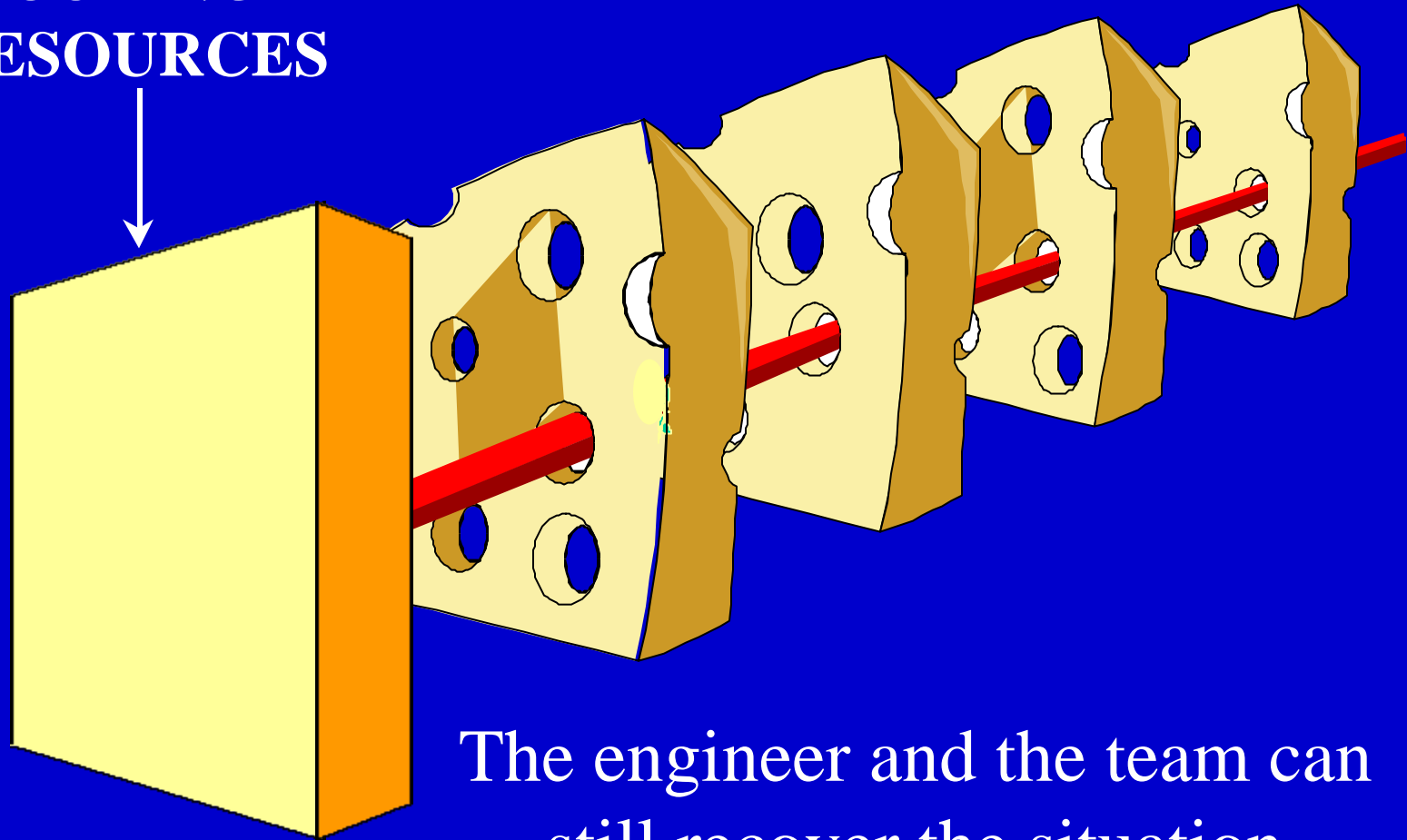


*Sometimes the holes can line up*



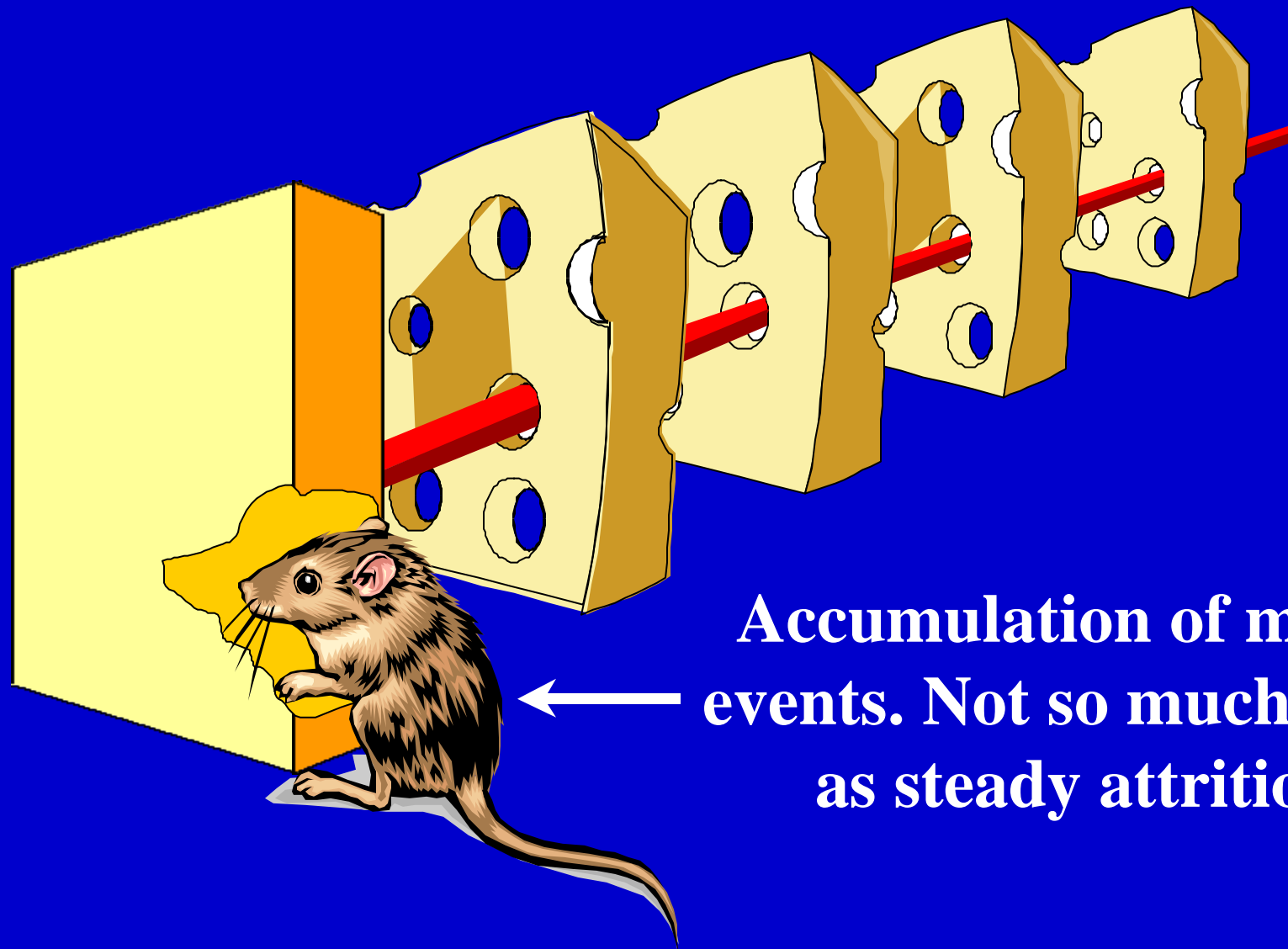
*But that is not the  
end of the story*

COPING  
RESOURCES



The engineer and the team can  
still recover the situation

# *Limited coping resources can get nibbled away*



**Accumulation of minor  
events. Not so much holes  
as steady attrition**



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- Errors can be detected and recovered before they do harm.
- But these coping resources are limited.
- They can get eaten away by the steady accumulation of minor stresses.
- Most of these stresses are system-related and need to be managed.